

CLAIMS

What is claimed is:

1. A prosthetic heart valve testing apparatus, comprising:
a test chamber;
a slide plate slidingly coupled to said test chamber, said slide plate having an opening formed therein that is adapted to receive a prosthetic heart valve to be tested in said
5 test chamber;
a storage member containing a plurality of prosthetic heart valves to be tested in said test chamber; and
a load/unload means for transferring at least one of said heart valves in said storage member between said storage member and said slide plate.
2. The apparatus of claim 1, further comprising a differential pressure sensor coupled to said test chamber, said differential pressure sensor adapted to sense a pressure differential across a prosthetic heart valve during a test performed in said test chamber.
3. The apparatus of claim 1, further comprising a pump for circulating a test fluid through said test chamber.
4. The apparatus of claim 1, further comprising a compliance chamber and a pinch valve in fluid communication with said test chamber.
5. The apparatus of claim 1, wherein said test chamber is comprised of an acrylic tube.
6. The apparatus of claim 1, wherein said slide plate is comprised of stainless steel.
7. The apparatus of claim 1, wherein said slide plate is sealingly coupled to said test chamber by a plurality of O-rings.

8. The apparatus of claim 1, further comprising a stepper motor coupled to said storage member, said stepper motor adapted to index said storage member from a first position to a second position.

9. The apparatus of claim 1, wherein said load/unload means comprises first and second cylinders, each of which have end portions that are adapted to engage a heart valve holder positioned in an opening in said storage member, said heart valve holder having a prosthetic heart valve positioned therein.

10. The apparatus of claim 1, further comprising a means for rotating said heart valve positioned in said slide plate.

11. The apparatus of claim 10, wherein said means for rotating said heart valve comprises:

a rack;

5 a plurality of gears operatively coupled to a heart valve holder having said heart valve positioned therein; and

a cylinder coupled to said rack.

12. The apparatus of claim 1, wherein said storage member is a disc having a plurality of openings formed therein, each of which is adapted to have a prosthetic heart valve positioned therein.

13. The apparatus of claim 1, further comprising a cylinder coupled to said slide plate that is adapted to move said slide plate relative to said test chamber.

14. A prosthetic heart valve testing apparatus, comprising:

a test chamber;

5 a slide plate slidably coupled to said test chamber, said slide plate having an opening formed therein that is adapted to receive a prosthetic heart valve to be tested in said test chamber;

- a storage member containing a plurality of prosthetic heart valves to be tested in said test chamber;
- a load/unload means for transferring at least one of said heart valves in said storage member between said storage member and said slide plate;
- 10 a means for moving said slide plate relative to said test chamber to allow positioning of a prosthetic heart valve in said test chamber; and
- a means for rotating a heart valve positioned in said slide plate.

15. The apparatus of claim 14, further comprising a differential pressure sensor coupled to said test chamber, said differential pressure sensor adapted to sense a pressure differential across a prosthetic heart valve during a test performed in said test chamber.

16. The apparatus of claim 14, further comprising a pump for circulating a test fluid through said test chamber.

17. The apparatus of claim 14, further comprising a compliance chamber and a pinch valve in fluid communication with said test chamber.

18. The apparatus of claim 14, wherein said test chamber is comprised of an acrylic tube.

19. The apparatus of claim 14, wherein said slide plate is comprised of stainless steel.

20. The apparatus of claim 14, wherein said slide plate is sealingly coupled to said test chamber by a plurality of O-rings.

21. The apparatus of claim 14, further comprising a stepper motor coupled to said storage member, said stepper motor adapted to index said storage member from a first position to a second position.

22. The apparatus of claim 14, wherein said load/unload means comprises first and second cylinders, each of which have end portions that are adapted to engage a heart valve holder positioned in an opening in said storage member, said heart valve holder having a prosthetic heart valve positioned therein.

23. The apparatus of claim 14, wherein said means for rotating said heart valve comprises:

a rack;

a plurality of gears coupled to a heart valve holder having said heart valve positioned therein; and

a cylinder coupled to said rack.

24. The apparatus of claim 14, wherein said storage member is a disc having a plurality of openings formed therein, each of which is adapted to have a prosthetic heart valve positioned therein.

25. The apparatus of claim 14, wherein said means for moving said slide plate relative to said test chamber comprises a cylinder coupled to said side plate.

26. A prosthetic heart valve testing apparatus, comprising:

a test chamber;

a slide plate slidably coupled to said test chamber, said slide plate having an opening formed therein that is adapted to receive a prosthetic heart valve to be tested in said test chamber;

a storage member containing a plurality of prosthetic heart valves to be tested in said test chamber;

first and second cylinders, each of which have end portions that are adapted to engage a heart valve holder positioned in an opening in said storage member, said heart valve holder having a prosthetic heart valve positioned therein, said first and second cylinders further adapted to remove said heart valve holder and heart valve from said storage member and position said heart valve holder and heart valve in an opening in said slide plate; and

15 a third cylinder coupled to said slide plate, said third cylinder adapted to move said slide plate relative to said test chamber to thereby position said heart valve in said slide plate in said test chamber.

27. The apparatus of claim 26, further comprising a differential pressure sensor coupled to said test chamber, said differential pressure sensor adapted to sense a pressure differential across a prosthetic heart valve during a test performed in said test chamber.

28. The apparatus of claim 26, further comprising a pump for circulating a test fluid through said test chamber.

29. The apparatus of claim 26, further comprising a compliance chamber and a pinch valve in fluid communication with said test chamber.

30. The apparatus of claim 26, wherein said test chamber is comprised of an acrylic tube.

31. The apparatus of claim 26, wherein said slide plate is comprised of stainless steel.

32. The apparatus of claim 26, wherein said slide plate is sealingly coupled to said test chamber by a plurality of O-rings.

33. The apparatus of claim 26, further comprising a stepper motor coupled to said storage member, said stepper motor adapted to index said storage member from a first position to a second position.

34. The apparatus of claim 26, further comprising a means for rotating said heart valve positioned in said slide plate.

35. The apparatus of claim 34, wherein said means for rotating said heart valve comprises:

a rack;
a plurality of gears coupled to a heart valve holder having said heart valve positioned
5 therein; and
a cylinder coupled to said rack.

36. The apparatus of claim 26, wherein said storage member is a disc having a plurality of openings formed therein, each of which is adapted to have a prosthetic heart valve positioned therein.

37. A heart valve testing apparatus, comprising:
a test chamber, said test chamber having a heart valve positioned therein for testing;
a compliance chamber and a pinch valve in fluid communication with a portion of
said chamber on an outflow side of said heart valve;
5 a pump for circulating a test fluid through said test chamber, said heart valve, said compliance chamber and said pinch valve;
a computer for controlling said pinch valve to regulate the flow of said test fluid through said pinch valve to thereby assist in controlling a pressure in said test chamber on said outflow side of said heart valve.

10 38. The apparatus of claim 37, further comprising a supply tank downstream of and in fluid communication with said pinch valve, said supply tank having a level sensor that is controlled by said computer to control the level of test fluid in said supply tank.

39. The apparatus of claim 37, wherein said compliance chamber is comprised of at least two air-filled diaphragms.

40. The apparatus of claim 37, wherein said pump is a reciprocating pump.

41. The apparatus of claim 37, wherein said pinch valve is a lead screw driven clamping device.

42. The apparatus of claim 37, wherein said pinch valve is actuated by a stepper motor.

43. A method of testing prosthetic heart valves, comprising:

providing a prosthetic heart valve testing apparatus, said apparatus comprised of a test chamber and a storage member, said storage member having a plurality of prosthetic heart valves stored therein;

- 5 positioning said storage member in a first position;
moving a first heart valve from said storage member in said first position to said test chamber;
performing at least one test on said first heart valve in said test chamber;
returning said first heart valve from said test chamber to said storage member;
10 moving said storage member to a second position to position a second of said plurality of heart valves for removal from said storage member;
moving said second heart valve from said storage member to said test chamber;
performing at least one test on said second heart valve in said test chamber; and
returning said second heart valve to said storage member.

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44. The method of claim 43, wherein moving a first heart valve from said storage member in said first position to said test chamber comprises:

actuating a first and a second cylinder to remove said first heart valve from said storage member and position said first heart valve in a slide plate of said apparatus

- 5 that is slidably coupled to said test chamber; and
actuating a third cylinder to move said slide plate having said first heart valve positioned therein into a test position in said test chamber.

45. The method of claim 43, wherein performing at least one test on said first heart valve in said test chamber comprises performing at least one of a proof test and a functional test on said first heart valve in said test chamber.

- 5 46. The method of claim 44, wherein returning said first heart valve from said test chamber to said storage member comprises:

actuating said third cylinder to move said slide plate having said first heart valve positioned therein to a load/unload position proximate said storage member; and actuating said first and second cylinders to remove said first heart valve from said slide plate and position said first heart valve in said storage member.

47. The method of claim 43, wherein moving said storage member to a second position to position a second of said plurality of heart valves for removal from said storage member comprises actuating a stepper motor coupled to said storage member to move said storage member to a second position so as to position a second of said plurality of heart valves for removal from said storage member.

48. The method of claim 47, wherein moving a second heart valve from said storage member to said test chamber comprises:
actuating said first and said second cylinders to remove said second heart valve from said storage member and position said second heart valve in a slide plate of said apparatus that is slidably coupled to said test chamber; and
actuating a third cylinder to move said slide plate having said second heart valve positioned therein into a test position in said test chamber.

49. The method of claim 43, wherein performing at least one test on said second heart valve in said test chamber comprises performing at least one of a proof test and a functional test on said second heart valve in said test chamber.

50. The method of claim 48, wherein returning said second heart valve from said test chamber to said storage member comprises:
actuating said third cylinder to move said slide plate having said second heart valve positioned therein to said load/unload position proximate said storage member; and
actuating said first and second cylinders to remove said second heart valve from said slide plate and position said second heart valve in said storage member.